Docket No. MCEJ101.CIP

CASTING FORM FOR A CAST-IN-PLACE COLUMNAR STRUCTURAL ELEMENT AND FENCING SYSTEM INCLUDING CAST-IN-PLACE COLUMNAR STRUCTURAL ELEMENTS

INVENTOR:

JOHN D. McENROE, JR.

CERTIFICATE OF EXPRESS MAILING

I HEREBY CERTIFY that this correspondence is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated below, in an envelope addressed to the Commissioner of Patents and Trademarks, PO Box 1450, Alexandria VA 22313-1450.

DATE OF DEPOSIT: 7/2/2003

EXPRESS MAIL LABEL NO: EV 154644823 US

Signature

Kelly Y. Johnson

Printed Name

(001) TITLE: Casting Form for a Cast-in-place Structural Element and Fencing System Including Cast-in-Place Structural Elements

(002) INVENTOR: John D. McEnroe, Jr.

(003) RELATED APPLICATIONS: This application claims the priority of U.S. Non-Provisional Utility Patent Application Serial Number 10/064,094 entitled Casting Form for a Cast-In-Place Columnar Structural Element and Fencing System Including Cast-in-place Columnar Structural Elements, filed October 2, 2002, which claims the benefit of Provisional Application Serial Number 60/394,638 entitled Casting Form for a Cast-In-Place Columnar Structural Element and Fencing System Including Cast-in-place Columnar Structural Elements, filed July 8, 2002.

BACKGROUND

(004) Field of Invention. The present invention relates to building methods and devices and more particularly to a method and apparatus for casting a structural element in-place and to a fencing system including a plurality of cast-in-place columnar structural elements.

(005) Prior Art. Structural elements formed of a variety of materials and utilizing a vast number of methods and used for a wide assortment of purposes are known in the art. Concrete structural elements are precast in a variety of sizes and configurations and are used for any number of applications.

(006) Fence posts are one form of a columnar structural element. Fence posts have historically included a variety of materials including wood, composite, masonry and metal structural members, any of which may be affixed to the ground by being placed in the ground employing compacted earth or concrete fill around the member placed in a post hole. Popular fencing techniques have historically favored the use of wood posts as a common material for fencing due both to the availability of and the relative ease of working with wood. Commonly, fence posts are supported in the ground either by compacted earth fill or preferably by pouring concrete around a

post placed in a post hole. In those cases where concrete is the material used to form a fence post, the posts are erected, in the case of pre-cast posts, or in the case of cast-in-place concrete posts, the posts are formed and poured. During the pour it is common that each post be stabilized laterally sometimes by more than one "kicker" so that the form remains upright during the pour. After the concrete has cured, the supports are removed, the forms stripped and the interconnecting horizontal elements are connected to the posts.

(007) When considering the choice of wood as a material for a partially buried columnar structural element, it has been observed that wood is subject to attack by a variety of environmental elements and is subject to rot. Historically, one solution to the relatively short life cycle of wood posts has been to chemically treat the post so as to reduce moisture absorption and the adverse affects of various environmental elements.

(008) The use of various chemicals used for treatment of wood to be used for columnar structural elements including fence posts has, in some instances, proven to be unacceptable or undesirable for a variety of reasons including environmental concerns. It may, therefore, be advantageous to provide an alternative structural member, and method of erection of an alternative structural member, to presently used chemically treated wood posts for use in fencing construction.

(009) The use of concrete fence posts per se is well known in the prior art. Historically, however, it appears that pre-cast or prefabricated concrete posts have been favored over efforts to provide for a cast-in-place post. This may in part be due to the fact that concrete forms have typically been heavy and cumbersome. The task of transporting forms to a plurality of post holes, erecting the forms at the post holes, stripping and cleaning the forms, and transporting the forms from the jobsite have presented substantial hurdles to the use of cast-in-place concrete for fencing systems. Nevertheless, there have been attempts.

(010) U.S. Patent No. 5,593,623, to Mohss, entitled Casting Mould discloses a casting mould for containing and supporting a casting compound when casting elongated objects, on an underlayer and extending vertically which includes a substantially inelastic flexible elongated envelope having an opening at one or both

ends. The envelope is held in substantially vertical alignment while being stretched by cast compound introduced through the upper opening so as to form a casting mould having a circular cross-section, extending vertically and supporting and containing the cast compound. Mohss discloses that the substantially inelastic flexible elongated envelope be held manually during the casting process.

(011) U.S. Patent 5,580,480 to Chatelain entitled Form For Making Fence Posts in Situ discloses a form for making a concrete fence post supported by the ground. The form includes two elongated halves which are hinged together and clamped along one edge. The form is supported over a post hole by a pair of feet that sit on the surface of the ground and which are attached to the two elongated halves. Concrete is poured into the form. Reinforcing bars or mesh is inserted in the wet concrete and the concrete is permitted to set. The form is opened and removed resulting in a reinforced concrete fence post. A plurality of apertures may be formed in the post by sliding a solid rod through a pair of opposing apertures located in the two elongated halves. The rods may be withdrawn from the f form when the concrete and the form when the concrete has set. A cable is then passed through the aperture to form a horizontal fencing member.

(012) U.S. Patent No. 5,946,881, also to Chatelain, entitled Form for Casting a Concrete Fence Post in Situ and Process for its Use discloses a form for casting a concrete fence post in place and the process of using the form. The form has elongated first and second halves, each having outwardly extending flanges which are attached together to form a cavity in the shape of a finished fence post. The form halves are either slightly tapered or fastened by fasteners which may be loosened so that the form can be easily lifted off the resulting cured concrete post. The process for using the form includes the steps of placing the post form over a post hole and pouring wet concrete into the top of the post form. The wet concrete is allowed to cure and then the form is lifted off the cured post.

(013) Both of the above references disclose reusable forms which therefore do not solve the issues of dealing with relatively heavy reusable forms.

(014) U.S. Patent 3,024,512 to Dyer entitled Disposable Concrete Form for Posts and Columns discloses a form used for casting posts and the like in place. The

form is made of a semi rigid sheet material such as cardboard or plastic that may be stripped and disposed of after use. The form is supported over the hole by means of tabs located near a lower end of the form which are place in contact with the surface of the ground adjacent the post hole. The disadvantage of such a system lies in part with the fact that the support tabs may be useless in situations wherein the post hole is oversized or in situations wherein the post hole is located on a slope or incline.

(015) It may be advantageous, therefore, to provide a disposable form for pouring or casting a structural element in-place.

(016) There may also be advantage found in providing a method for erecting a fence that includes the steps of erecting a form for a cast-in-place post using a disposable structural element casting form, connecting one or more horizontal members to the disposable structural element casting form before casting the cast-in-place post and casting the cast-in-place post.

SUMMARY

(017) The present invention is directed to a casting form including a pliable tubular segment, open at a first end and a form suspension assembly attachable between the pliable tubular segment and a form support member. The form support member is erected on a surface contiguous to a substrate upon which the cast-in-place structural element is to be formed for suspending the pliable tubular segment from the form support member above the substrate.

(018) In one preferred embodiment of the invention, the pliable tubular segment is suspended from the form support member with a first end of the pliable tubular segment attached to the form support member with the pliable tubular segment positioned about the form support member. In this embodiment, the form support member is erected on a surface internal to a sidewall of the pliable tubular segment. In this embodiment, the form support member may serve both to support the pliable tubular segment during the casting process and as a reinforcing member, strengthening and reinforcing the cast member following casting.

(019) In an alternate embodiment of the invention, the pliable tubular segment is attached to a form support member that is erected on a surface contiguous to a substrate upon which the cast-in-place structural element is to be formed which is external to a sidewall of the pliable tubular segment.

(020) The term "pliable" as used herein means foldable and/or rollable along both the length and the width of the material. The use of a pliable material for the form provides a significant reduction in bulk or volume and therefore may reduce costs associated with shipping and transport of the casting form. For instance, the material for the pliable tubular segments for several hundred linear feet of fencing may be contained on a single roll that may be easily carried by a single individual. In one preferred embodiment, the pliable tubular segment is configured as a cylindrical sleeve formed of a polyethylene material having a thickness in the range of 4 to 40 mils. Preferably, the pliable tubular segment is formed of a sheet polymer having a thickness in the range of 5 to 10 mils. In one preferred embodiment, the pliable tubular segment is formed of a sheet polymer having a thickness substantially equal to 6 mils. The cylindrical sleeve may be produced on a roll and cut to length or as required. The pliable tubular segment may be formed of a material that may be stripped away following curing of the casting compound. The pliable tubular segment may be formed of a material that is disposable after use.

(021) Alternately, the pliable tubular segment may be formed of a material that may form a finished surface to the cast-in-place structural element or, in the alternative, may form a surface that may be finished by coating or covering, for instance by grout, stucco or paint. Additionally, due to the fact that the form is configured as a pliable tubular segment, it is conceivable that an outer surface of the casting may be embossed during a curing period for the casting compound in such a manner that a finished outer surface of the casting may include an embossed or textured surface, for instance replicating a stone or wood surface.

(022) In an alternate preferred embodiment, the pliable tubular segment may include reinforcement strips affixed to the wall of the pliable tubular segment to provide added tensile strength to the girth or the length of the pliable tubular segment. A reinforcement strip may be formed at the first end of the form simply by

rolling the pliable tubular segment back upon itself forming a collar having a plurality of layers. Alternately, a reinforcement strip may be formed of a polymer sheet material attached to the pliable tubular segment in locations as required by welding. A preferred method of attachment of a reinforcement strip to the pliable tubular segment is by means of plastic or impulse welding. For instance, it may be desirable to reinforce the first end of the pliable tubular segment from which the weight of the form suspends, by welding one or more additional strips of material along the first end of the pliable tubular segment. Similarly, it may be desirable to reinforce the pliable tubular segment by adding reinforcement strips along the length of the pliable tubular segment, particularly above and below locations at which pockets are formed in the pliable tubular segment for supporting a connecting member during the casting of the cast-in-place structural element.

(023) The form suspension assembly may be configured as a strap having a first end connected near the first end of the pliable tubular segment at a first end connection point, and a second end connected near the first end of the pliable tubular segment at a second end connection point. Preferably, the first end connection point opposes the second end connection point. The strap is attachable between the form support member and the pliable tubular segment allowing the pliable tubular segment to be suspended from the form support member.

(024) Alternately, the form suspension assembly may include a form carriage including, in one embodiment, a form support ring. Preferably, the form support ring has a perimeter shaped according to the desired finished cross-section of the uppermost end of the columnar structural element being cast. The form support ring is attachable to the form support member by one or more support arms which interconnect the form support ring and a form carriage connector element which attaches to the support member.

(025) The casting form may also include a form positioning and dampening assembly positioned near a lower end of the pliable tubular segment and attached to the structural support member and an adjacent fixed surface, for instance an interior surface of a fence post hole. In one embodiment, the form positioning and dampening assembly includes a ring connected to the structural support member.

Preferably, the ring slideably and frictionally engages the structural support member such that the ring may be positioned at a selected elevation along the length of the structural support member. Also preferably, the ring included one or more perorations to permit passage of concrete through the ring. In one preferred embodiment, a plurality of positioning arms extend from the ring to contact the adjacent post hole wall.

(026) In one preferred embodiment, the support member includes a metal structural member that is driven into the substrate. For example, the support member may be configured as a length of reinforcing steel bar (rebar). In one preferred embodiment, a hole is excavated at a desired location for erection of a cast-in-place structural element. The rebar is driven into the substrate located at the bottom of the excavated hole. In one preferred embodiment, a length of ½ inch rebar is driven 12 inches into the substrate to provide the requisite support structure. The rebar is preferably driven into the substrate such that a longitudinal axis of the rebar is oriented in a substantially vertical manner.

(027) In one preferred embodiment, a fencing system includes first and second structural support members erected on a substrate, with a first pliable tubular segment attached to and suspended from the first structural support member, and a second pliable tubular segment attached to and suspended from the second structural support member. A first end of one or more connecting members are attached to first connecting member attachment assemblies of the first casting form and a second end of one or more connecting members are attached to second connecting member attachment assemblies of the second casting form. In the preferred embodiment of the fencing system, a curable casting mixture is cast-in-place within the pliable tubular segments following installation of the connecting member(s), although in alternate preferred embodiments, the one or more connecting members may be attached to the first and second fence posts following casting and curing of the casting material.

(028) In one preferred embodiment, the connecting member support assembly is configured to receive or support an end of a connecting member. The connecting member support assembly may include a rail blockout formed as a pocket extending

across the aperture formed through the pliable tubular segment attaching at substantially opposing walls of the pliable tubular segment and configured to receive or form a blockout for a void for receiving a connecting member from either side of the structural member following casting. In the alternative the pocket may attach to the sidewall at a single location of the pliable tubular segment and may be configured to receive or form a blockout for a void for receiving a connecting member at a single location along the length of the structural member following casting. The attachment assembly may be formed of a pliable polymeric material attached to the wall of the pliable tubular segment at the location at which connection of the connecting member to the cast-in-place structural element is desired. The pocket extends into the interior of the pliable tubular segment. The pocket is configured to permit insertion of an end of the connecting member into the pocket. Preferably, the pocket is attached by impulse or plastic welding, forming preferably, a water tight connection at the juncture of the pocket and the sidewall.

(029) Alternately, the connecting member attachment assemblies may be configured for attachment to the structural support members by a variety of means. The connecting member support assembly may include an axis that intersects the support member or in the alternative variations of the connecting member support assembly may be attached to the support member in a manner wherein the axis of connecting member support assembly does not intersect support member, but rather passes alongside the support member. In such embodiments either or both the axis of connecting member support assembly and the support member may lie eccentric to a center of the diameter of a posthole in which the casting form is being installed. Additionally, the connecting member support assembly may be configured as a single tubular element that attaches to the support member or in the alternative it may be configured including an assembly of two or more members connectable to the support member and/or one another. Alternately, the connecting member attachment assemblies may be configured as a rigid member that supports an end of a connecting member. Alternately, the connecting member support assembly may include a tacking strip affixed to the inner surface of the pliable tubular segment

and to which wire or other connecting materials may be attached by nailing, stapling or the like.

(030) Additionally, the fencing system may include a variety of devices which permit attachment of assorted fencing elements and accessories to the cast-in-place column. For instance, a gate may be hung from the cast-in-place column by attaching a lag shield into the column to which a threaded connection may be made following the casting of the column.

(031) A method for erecting a fencing system, according to the present invention includes the steps of erecting a first structural support member on a substrate, erecting a second structural support member on the substrate within a selected proximity to the first structural support member, placing a first pliable tubular segment about the first structural support member and attaching the first pliable tubular segment to the first structural support member so that the first pliable tubular segment is suspended from and about the first structural support member, placing a second pliable tubular segment about the second structural support member and attaching the second pliable tubular to the first structural support member so that the second pliable tubular segment is suspended from and about the second structural support member, a first end of a connecting member is inserted into and supported by a first connecting member support assembly, a second end of a connecting member is inserted into and supported by a second connecting member support assembly and a curable casting mixture is cast-in-place within the first pliable tubular segment and the second first pliable tubular segment.

(032) A method for erecting a fence includes the steps of erecting a first form support member on a substrate, erecting a second form support member on the substrate, suspending a first pliable tubular segment from the first form support member, suspending a second pliable tubular segment from the second form support member, attaching a first connecting member first end to the first pliable tubular segment, attaching the first connecting member second end to the second pliable tubular segment, placing a casting mixture in the first pliable tubular segment forming a first cast-in-place post.

(033) The present invention consists of the device hereinafter more fully described, illustrated in the accompanying drawings and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

DRAWINGS

(034)

Figure 1 is a representative perspective view of a fencing system being erected according to the teachings of the present invention;

Figure 2 is a representative cutaway side view of a casting form for forming a cast-in-place fence post to which a plurality of horizontal connecting members have been attached prior to casting the fence post in place;

Figure 3 is a representative cutaway side view of a cast-in-place fence post showing horizontal connecting members supported by the fence post;

Figure 4 is a representative cutaway side view detail of a casting form for forming a cast-in-place fence post to which a plurality of horizontal connecting members have been attached;

Figure 5 is a representative cutaway side view detail of one embodiment of a form suspension assembly;

Figure 6 is a representative perspective view of a form support assembly supporting a pliable tubular form;

Figure 7 is a representative cutaway side view detail of a form suspension assembly;

Figure 8 is a representative cutaway side view detail of one means for attaching a pliable tubular segment to a form suspension assembly;

Figure 9 is a representative perspective view of a form support assembly supporting a pliable tubular form;

Figure 10 is a representative perspective view of an upper end of a pliable tubular segment which is modified to include a form suspension assembly;

Figure 11 is a representative side view detail of a form support assembly supporting a pliable tubular form and a connecting member attachment assembly;

Figure 12 is a representative front view detail of a form support assembly supporting a pliable tubular form and a connecting member attachment assembly;

Figure 13 is a representative cutaway side view detail of one means for attaching a form suspension assembly to a form support member;

Figure 14 is a representative side cutaway view of a connecting member attachment assembly;

Figure 15 is a r representative perspective cutaway view of a connecting member attachment assembly;

Figure 16 is a representative side cutaway view of an connecting member attachment assembly attached to and supported by the form support member;

Figure 17 is a representative top cutaway view of an connecting member attached to and supported by the form support member;

Figure 18 is a cutaway side view detail of a casting form including a hard pocket connecting member attachment assembly;

Figure 19 is a cutaway top view detail of a casting form including a hard pocket connecting member attachment assembly;

Figure 20 is a representative top cutaway detail of a casting form including a four module hard pocket connecting member attachment assembly;

Figure 21 is a cutaway top view detail of a casting form including a hard pocket connecting member attachment assembly;

Figure 22 is a cutaway top view detail of a casting form including a hard pocket connecting member attachment assembly;

Figure 23 is a cutaway top view detail of a casting form including a hard pocket connecting member attachment assembly;

Figure 24 is a representative side view cutaway detail of a pocket for a connecting member attachment assembly including a seal ring;

Figure 25 is a representative side view cutaway detail of a pocket for a connecting member attachment assembly including a seal ring and a pocket cutter edge;

Figure 26 is a representative side view cutaway detail of a casting form including a connecting member attachment assembly including a seal ring and a pocket cutter edge;

Figure 27 is a representative side view cutaway detail of a casting form including a connecting member attachment assembly including a rail spike attachable to the form support member;

Figure 28 is a representative side view cutaway detail of a casting form including a connecting member attachment assembly including a connecting member spacer attachable to the form support member and a connecting member crushable spacer;

Figure 29 is a representative side view cutaway detail of a casting form including a lag shield attached to the form support member;

Figure 30 is a representative side view cutaway detail of a casting form including a lag shield attached to the form support member showing a plug to seal the shield during casting and showing a hinge pin insertable after casting;

Figure 31 is a representative side view cutaway detail showing a form positioning and dampening assembly;

Figure 32 is a representative side view cutaway detail showing a collar for the form positioning and dampening assembly;

Figure 33 is a representative perspective view of an alternate form shape for a casting form for a structural shape;

Figure 34 is a representative perspective view of an alternate form shape for a casting form for a structural shape;

Figure 35 is a representative perspective view of an alternate form shape for a casting form for a structural shape adapted for casting a pier and post structural shape;

Figure 36 is a representative perspective view of an alternate form shape for a casting form for a structural shape adapted for casting a pier and post structural shape;

Figure 37 is a representative perspective partial cross-sectional view of a form support assembly supporting a pliable tubular form;

Figure 38 is a representative perspective partial cross-sectional view of a form support assembly supporting a pliable tubular form;

Figure 39 is a representative perspective detail view of a form support assembly supporting a pliable tubular form and a form suspension assembly;

Figures 40 through 42 are representative perspective views of a cast-in-place structural element casting form including a connecting member attachment assembly; and

Figure 43 is a schematic representation of a post formed with the devices and according to the methods or the present invention.

DETAILED DESCRIPTION

(035) Referring to Figure 1, fencing system 10 is shown including a plurality of fence posts 11a through 11e and casting forms 30a and 30b including pliable tubular segments 31a and 31b suspended from form support members 15a and 15b. Casting forms 30a and 30b are shown erected and awaiting placement of a curable casting mixture into casting forms 30a and 30b. A plurality of substantially horizontal connecting members, denoted generally by the numeral 12, are shown supported by the plurality of fence posts 11a through 11e and casting forms 30a and 30b. It will be noted that connecting member 12 may be supported by casting forms 30a and 30b prior to the placement of a curable casting mixture into the forms.

(036) Figure 2 is a representative cross-sectional view of casting form 30 including pliable tubular segment 31 placed about structural support member 15 suspended from form suspension assembly 50. Casting form 30 includes longitudinal axis LA. Structural support member 15 is driven into substrate S of post hole PH. In the embodiment shown in Figure 2, casting form 30 also includes connecting member attachment assemblies 80a through 80f for supporting and positioning connecting members 12a through 12f relative to casting form 30 before and during the placement and curing of a curable casting mixture in pliable tubular segment 31.

(037) Figure 3 is a representative cross-sectional view of fence post 5 formed of concrete 6 cast about structural support member 15. Structural support member 15

is driven into substrate S. An end of connecting members 12a through 12f respectively are held and supported by blockouts 7a through 7f respectively, formed about the ends of connecting members 12a through 12f when concrete 6 is placed in casting form 30 as shown in Figure 2.

(038) Figure 4 is a representative cross-sectional view of casting form 30 including pliable tubular segment 31 placed about structural support member 15, suspended from form suspension assembly 50 with structural support member 15 being stabilized by form positioning and dampening assembly 20. Figure 4 shows a preferred embodiment of the invention wherein the form support member is erected on a surface internal to a sidewall of the pliable tubular segment. Structural support member 15 is driven into substrate S of post hole PH. In the embodiment shown in Figure 4, casting form 30 also includes longitudinal axis LA. Connecting member attachment assemblies 80a through 80f support and position connecting members 12a, 12c and 12 e ,shown in Figure 4, relative to casting form 30 before and during the placement and curing of a curable casting mixture in pliable tubular segment 31. Connecting member attachment assemblies 80a through 80f are formed including soft pockets 81a through 81f. Soft pockets 81d through 81f are attached to pliable tubular segment 31. Connecting members 12a, 12c and 12e are shown in various stages of positioning and placement in soft pockets 81a, 81c and 81e of connecting member attachment assemblies 80a, 80c and 80e.

(039) Referring to Figs. 5 through 7 casting form 30 is shown including form support member 15 and pliable tubular segment 31 including sidewall 37. Pliable tubular segment 31 is suspended from form suspension assembly 50 about form support member 15. Form suspension assembly 50 includes suspension assembly connector 53 which is configured as a cap for placement on the uppermost end of form support member 15. A plurality of support ring support arms 52 are attached to and extend radially from suspension assembly connector 53. In the embodiment shown in Figure 5, pliable tubular segment 31 is formed having support ring compartment 32 formed at first end 33 of pliable tubular segment 31. First end 33 of pliable tubular segment 31 includes support ring compartment 32 for containing form support ring 51. Form support ring compartment 32 may be formed by folding

first end 33 of pliable tubular segment 31 back upon itself and, in those instances wherein polyethylene sheet material is used to form pliable tubular segment 31, first end 33 is folded back upon itself about support ring 51 and may be joined by impulse or plastic welding to form support ring compartment 32.

(040) In the embodiment shown in Figure 6, a plurality of support ring support arms 52 are attached to suspension assembly connector 53 and extend radially for connection to first support ring member 55. Second support ring member 56 is sized for placement about the outer perimeter of first support ring member 55. In use, pliable tubular segment 31 is placed about form support member 15, with first support ring member 55 disposed within aperture 38 of pliable tubular segment 31. Second support ring member 56 is placed about the outer perimeter of first support ring member 55 and first end 33 of pliable tubular segment 31 is compressively engaged or pinched between first support ring member 55 and second support ring member 56. Following curing, second support ring member 56 and pliable tubular segment 31 may be stripped and disposed. Alternately, pliable tubular segment 31 may be formed of a material the decomposes in a relatively short period of time and may remain in place for the required period of time.

(041) In the embodiment of form suspension assembly 50 shown in Figure 7, a plurality of support ring support arms 52 are attached to suspension assembly connector 53 and extend radially for connection to support ring 57. As shown in Figure 7, support ring 57 includes apertures 54 which facilitate the flow of casting material past support ring 57. Figure 8 is a detailed side cutaway view of retainer ring 58 engaging retainer aperture 59. In use, and referring to Figures 7 and 8, pliable tubular segment 31 is placed about form support member 15, with support ring 57 disposed within aperture 38 of pliable tubular segment 31. Retainer ring 58 is forced against sidewall 37 near first end 33 of pliable tubular segment 31 into a retainer aperture 59 compressively engaging or pinching a portion of first end 33 between retainer ring 58 and retainer aperture 59.

(042) Figures 9 and 10 show alternate preferred embodiments of form suspension assembly 60, including a plurality of strap segments 61a through 61d are attached to pliable tubular segment 31. Figure 9 shows casting form 30 including form

support member 15 and pliable tubular segment 31. As shown in Figure 9 strap segments 61a through 61d attach near collar 34 of pliable tubular segment 31 and extend across the aperture open at first end 33. Strap segments 61a through 61d are simply set on top of form support member 15 at intersection 64 formed a location where 61a through 61d intersect.

(043) Referring to Figure 10, one method for the manufacture of form suspension assembly 60 is shown wherein pliable tubular segment 31 is modified and adapted to provide a plurality of strap segments 61a through 61d as shown. Strap segments 61a through 61d are cut out of the sidewall 37 of pliable tubular segment 31 near first end 33. Strap segments 61a through 61d are folded back upon themselves providing a reinforcement tab 63 at the end of each strap segment 61. Strap segments 61a through 61d are laid one over the other at intersection 64 and, in those instances wherein polyethylene sheet material is used to form pliable tubular segment 31, welded by impulse or plastic welding joining strap segments 61a through 61d. Aperture 62 may then be formed at intersection 64 by punching through the collective thicknesses of strap segments 61. First end 33 of pliable tubular segment 31 may be rolled back to form collar 34, (shown in Figure 9). Collar 34 serves as a horizontal or circumferential reinforcement strip.

(044) Referring to Figures 11 and 12, an alternate method for configuring form suspension assembly 70 is shown. Casting form 30 is shown including form support member 15 and pliable tubular segment 31. Pliable tubular segment 31 is suspended from form suspension assembly 70 about form support member 15. Form suspension assembly 70 is formed as a stirrup hanger. In the embodiment shown, form suspension assembly 70 is formed of a polymer sheet material as strip 71 attached along a length of pliable tubular segment 31, forming first reinforcement strip 72. Strip 71 spans first end 33 of pliable tubular segment 31, forming strap 73. Strip 71 is then attached along a length of pliable tubular segment 31 forming second reinforcement strip 74 which is substantially opposite from first reinforcement strip 72. Strap 73 may be formed by folding or rolling the mid-length portion of strip 71 so as to decrease overall width and increase overall thickness of the mid-length portion of strip 71 forming strap 73. The folded or rolled section may

be spot welded to retain the desired configuration. First reinforcement strip 72 and second reinforcement strip 74 provide additional thickness and increased tensile strength to the length of pliable tubular segment 31. First reinforcement strip 72 and second reinforcement strip 74 may be formed of a polymer sheet material attached to pliable tubular segment 31 by means of plastic or impulse welding.

(045) Figure 11 also shows first end of connecting member 12 inserted in blockout 75 of connecting member support assembly 70 for supporting and positioning connecting member 12 relative to casting form 30 before and during the placement and curing of a curable casting mixture in pliable tubular segment 31. Casting form 30 is shown also including blockout 76 for accepting placement of an end of a second connecting member, (not shown), through sidewall 37 of pliable tubular segment 31.

(046) Referring to Figure 13, suspension assembly connector 65 may be employed to position and support pliable tubular segment 31 such that first end 33 of pliable tubular segment 31 is located above upper end 16 of form support member 15. Suspension assembly connector 65 is adapted to be placed over upper end 16 of form support member 15 and includes a platform 67 for supporting straps 61 of form suspension assembly 60. Threaded aperture 66 of threaded retainer 68 engages suspension assembly connector 65 and retains pliable tubular segment 31 in position during casting relative to support member 15.

(047) Figure 14 shows pliable tubular segment 31 placed about form support member 15. Pliable tubular segment 31 is formed including connecting member attachment assemblies 80a and 80b connected to sidewall 37 of pliable tubular segment 31. First end 13a of connecting member 12a is positioned within connecting member support assembly 80a. For purposes of illustration, connecting member support assembly 80a will be described more fully with reference to Figure 15.

(048) Figure 15 shows casting form 30 including form support member 15, form suspension assembly 50 connected to form support member 15 and pliable tubular segment 31 attached to and suspending from form suspension assembly 50. Connecting member support assembly 80 includes pocket 81 which is formed from

first pocket segment 82 and second pocket segment 83. First pocket segment 82 includes aperture 84 including peripheral edge 85. First pocket segment 82 also includes peripheral edge 86. Second pocket segment 83 includes peripheral edge 87. Peripheral edges 86 and 87 are joined to form, preferably, a fluid proof barrier. In the case wherein pliable tubular segment 31 is formed of a polymer, peripheral edges of first pocket segment 82 and second pocket segment 83 may be joined by plastic or impulse welding. Similarly, peripheral edge 85 of aperture 84 may be joined to peripheral edge 39 of cutout 36 in sidewall 37 of pliable tubular segment 31 by impulse or plastic welding.

(049) Figures 16 and 17 show yet another alternate preferred embodiment of connecting member support assembly 95. In this embodiment, pliable tubular segment 31, including sidewall 37, is placed about form support members 15a and 15b. Connecting member support assembly 95 is shown including stirrup portion 98 which may be formed of a molded plastic and includes reinforcement member engaging elements 96 and 97. Reinforcement member engaging elements 96 and 97 are formed as tubular segments oriented to be placed over form support members 15a and 15b respectively allowing connecting member support assembly 95 to be slid down form support members 15a and 15b and positioned where desired. Referring to Figure 26, set screws 47a and 47b are used to retain connecting member support assembly 95 in position relative to support members 15a and 15b prior to and during the casting process. Connecting member support assembly 95 also includes spacer 99 which limits the travel of a connecting member (not shown) upon insertion into the connecting member support assembly 95.

(050) Figures 18 and 19 shows yet another alternative embodiment of connecting member support assembly 105. Pliable tubular segment 31 including sidewall 37 is placed about form support member 15. Connecting member support assembly 105 is shown including body portion 101 which may be formed of a molded plastic or other suitable material. In the embodiment shown, body portion 101 includes a plurality of apertures 109 which facilitate fluid flow of a casting material about connecting member support assembly 105. Body portion 101 also includes support member aperture 102 which is positionable about support member 15. Pockets

106a and 106b connect to body portion 101 and have an opposing orientation. In the embodiment shown, pockets 106a and 106b are oriented so that a longitudinal axis of pocket 106a and a longitudinal axis of pocket 106b lie substantially coaxially to one another along axis A. It is to be distinctly understood that other configurations and angular relationships are achievable and intended to be within the scope of the present invention. Body portion 101 includes aperture 102 sized to permit a sliding engagement of body portion 101 with form support member 15. Connecting member support assembly 105 may be slid down form support member 15 and positioned where desired. Set screw 17 retains connecting member support assembly 105 in a selected position prior to and during the casting process. Pockets 106a and 106b also include spacers 107a and 107b respectively located adjacent to back surfaces 108a and 108bfor maintaining gap G, as shown with reference to pocket 106b, between first end 13b of second connecting member 12b and a back surface 108b of pocket 106b. As shown, in Figure 19, additional rebar 15' are positioned within casting form 30 to provide additional structural reinforcement.

(051) Referring to Figure 20, casting form 30 is shown including pliable tubular segment 31 including sidewall 37. Casting form 30 is shown including an alternative embodiment of connecting member support assembly 110, including pockets 111a, 111b, 111c and 111d equally spaced about the periphery of casting form 30 for forming blockouts at four equally spaced intervals about the periphery of casting form 30. Pockets 111a, 111b, 111c and 111d are connected to body portion 113 having aperture 114 formed there through. Structural support member 15 inserts through aperture 114 and connecting member support assembly 110 is located along the length of structural support member 15 and secured in position by means of set screw 47. In the embodiment shown, pockets 111a and 111c are oriented so that a longitudinal axis of pocket 111a and a longitudinal axis of pocket 111c lie substantially coaxially to one another along axis A1. Similarly, pockets 111b and 111d are oriented so that a longitudinal axis of pocket 111b and a longitudinal axis of pocket 111d lie substantially coaxially to one another along axis A2.

(052) Referring to Figures 21 through 23, casting form 30 is shown including pliable tubular segment 31 including sidewall 37 and another alternative embodiment of connecting member support assembly 115. Here connecting member support assembly 115 is shown including molded hard pockets 116a and 116b. Pockets 116a and 116b are positioned to opposite sides of structural support member 15 and are attached one to the other using screws 117. As shown in Figure 23, additional pockets 120a and 120b are connected to pockets 116a and 116b with fasteners 121. As shown in Figure 21, hard pockets 116a and 116b are oriented so that a longitudinal axis of hard pocket 116a and a longitudinal axis of hard pocket 116b lie substantially coaxially to one another along axis A. Pockets 116a and 116b include spacers 118a and 118b respectively as shown in Figures 21 and 22. In Figure 22, pockets 116a and 116b are shown offset angularly, with a longitudinal axis A1 of pocket 116a intersecting a longitudinal axis A2 of pocket 116b.

(053) Referring to Figure 23, connecting member support assembly 115 is shown including pockets 116a and 116b and pockets 120a and 120b. In the embodiment shown, pockets 116a and 116b are oriented so that a longitudinal axis of pocket 116a and a longitudinal axis of pocket 116b lie substantially coaxially to one another along axis A1. Similarly, pockets 120a and 120b are oriented so that a longitudinal axis of pocket 120a and a longitudinal axis of pocket 120b lie substantially coaxially to one another along axis A2. As shown, pockets 116a and 116b are connected one to the other by screws 117. Fasteners 121 connect pockets 120a and 120b to pockets 116a and 116b forming a connecting member support assembly 115 which provides a casting form 30 for forming four substantially co-planar blockouts.

(054) It may be possible that various combinations of connecting member support assemblies may be utilized when a particular circumstance deems that it may be desirable. For instance, connecting member support assembly 80a and 80b shown in Figure 14 may be used separately or in the alternative, may be combined with connecting member support assembly 105 as shown in Figures 18 and 19 where additional weight bearing capacity is desired.

(055) Figures 24 through 26 illustrate hard pocket 130 including seal ring 131. Hard pocket 130 is positioned within pliable tubular segment 31. Seal ring 131 is

configured including a pocket cutter edge 132 which, when pressed against side wall 37 of pliable tubular segment 31, both cuts the sidewall 37 and seals the remaining pliable tubular segment 31 to pocket 130 forming a water tight joint between the sidewall 37 of pliable tubular segment 31 and pocket 130. Seal ring 131 includes pocket cutter edge 132 which may be configured as shown both to cut through sidewall 37 of pliable tubular segment 31 and to cooperate with lip 133 to hold a portion of sidewall 37 of pliable tubular segment 31 in compression to form preferably a substantially water tight seal with pliable tubular segment 31 between hard pocket 130 and seal ring 131. Referring to figure 26, first end 13 of connecting member 12 is shown positioned for insertion into pocket 130.

(056) Referring to Figures 27 and 28, casting form 30 is shown including pliable tubular segment 31, including sidewall 37, positioned about form support member 15. First end 13a of connecting member 12a is shown positioned in connecting member support assembly 80a. Casting form 30 also includes connecting member support assembly 80b. First end 13b of connecting member 12b is shown positioned for placement in connecting member support assembly 80b. As shown, casting form 30 includes spacer 89 for maintaining a distance between, as shown by way of illustration, first end 13a of connecting member 12a and form support member 15. Spacer 89 is located along the length of form support member 15 and secured in a selected position by means of set screw 88. In the embodiment shown in Figure 27, spacer 89 also includes connecting member retainer spikes 87a and 87b which provide a more secure attachment, particularly during the casting process, between connecting member 12a and casting form 30. In the embodiment shown in Figure 28, connecting member support assembly 80a includes a crushable spacer 77 which provides for a more secure fit about a periphery of , as shown by way of illustration, first end 13a of connecting member 12a. Crushable spacer 77 may be formed of any of a variety of compactable materials, for instance, a corrugated plastic sheet.

(057) Referring to Figures 29 and 30, a means is shown for connecting any of a variety of threaded components to a cast-in-place columnar structure. As shown, threaded component attachment assembly 140 includes body 142. Lag shield 141

attaches to and extends from body 142 contacting sidewall 37 of pliable tubular segment 31, shown in Figure 29. Lag shield 141 includes threaded aperture 144. As seen in Figure 29, plug 145 is configured to penetrate sidewall 37 of pliable tubular segment 31 and seal threaded aperture 144 during a casting process. Threaded component attachment assembly 140 is slideably positioned along the length of form support member 15 and fixed in a selected position by set screw 143. As shown in Figure 30, hinge pin 147 includes thread 146 for threadedly engaging threaded aperture 144 of lag shield 141 which is shown embedded in a cured casting compound 6 forming column 8. Jam nut 148 retains hinge pin 147 in a vertical orientation.

(058) Referring to Figure 31 form positioning and dampening assembly 20 is shown to advantage. Pliable tubular segment 31 is draped about form support member 15 and an outer peripheral edge of ring 21 near second end 35 of pliable tubular segment 31. Form positioning and dampening assembly 20 includes ring 21 including a plurality of arms 22. Collar 27 forms the hub of positioning and dampening assembly 20 and includes aperture 29, slideably disposed along form support member 15. In one embodiment, the plurality of arms 22 attach to collar 27 and extending radially through and supporting positioning ring 21. Each of the plurality of arms 22 may include pads 25 attached at a distal end of the arm for limiting penetration of the arm into sidewall SW of post hole PH, As form positioning and dampening assembly 20 is pushed into post hole PH, the plurality of arms 22 press against sidewall SW of post hole PH positioning form support member 15 with respect to sidewall SW of post hole PH and dampening vibrations to which form support member 15 may be subjected to during erection or casting processes.

(059) Referring to Figure 32 a side cutaway detail of collar 27. As shown, in Figure 32, one way flippers 28 extend radially inward from collar 27 into aperture 29. One way flippers 28 may be laminated into collar 27 when collar 27 is formed. Collar 27 is placed over form support member 15. As collar 27 is forced down along the length of form support member 15 one way flippers 28 create a resistance to the downward travel of collar 27 which may be overcome by a pushing force applied to

collar 27. Once positioned, collar will remain in place, and more particularly, collar 27 will resist upward travel due, for instance, to buoyancy.

(060) Figures 33 through 36 are representative perspective views of alternate configurations for casting forms 201 through 204 respectively. As shown, configurations for columnar member casting forms 201 through 204 may include various combinations of tubular segments 207 and fructose conical transitions 208 and 209. Additionally, configurations for columnar member casting forms as typified in by columnar member casting forms 201 through 204 may include various cap portions as typified by dome cap 205 and flat cap 206 Figures 33 through 36, particularly casting forms 203 and 204 demonstrate a feature of the present invention wherein the casting form is adaptable to form monolithic pier and post type structures. For example, referring to Figures 35 and 36 lower tubular pier segments 207 include a diameter that is substantially greater than uppermost post segments 211.

(061) Referring to Figures 37 and 38 alternate embodiments of the present invention are shown wherein the form support member is erected on a surface external to a sidewall of the pliable tubular segment. Referring to Figure 37, an alternate preferred embodiment of casting form 200 is shown including pliable tubular segment 231 suspended from structural support member 215. As shown, suspension assembly 250 attaches between structural support member 215 and pliable tubular segment 231. In the embodiment shown, structural support member 215 includes legs 201a, 201b, 201c and 201d which engage a surface L adjacent to a location upon which the cast-in-place structural element is to be cast, in this case substrate S of post hole PH. Legs 201a, 201b, 201c and 201d of structural support member 215 may be driven into surface L adjacent to a location upon which the cast-in-place structural element is to be cast, or in the alternative may simply be erected adjacent to the location at which the cast-in-place structural element is to be formed and cast. As seen in Figure 37, casting form 200 may include a separate reinforcing member 240.

(062) Figure 38 shows an alternate preferred embodiment of casting form 300 including pliable tubular segment 331 suspended from structural support member

315. As shown, form suspension assembly 350 attaches between structural support member 315 and pliable tubular segment 331. In the embodiment shown, structural support member 315 includes legs 301a, 301b and 301c which engage a surface L adjacent to a location upon which the cast-in-place structural element is to be cast, in this case substrate S of post hole PH. Curable casting mixture 6 has been placed in and is contained by pliable tubular segment 331.

(063) Figure 39 is a representative perspective detail view of form suspension assembly 250 supporting pliable tubular segment 231. Structural support member 215 includes legs 201a, 201b, 201c and 201d, each including upper distal end 202a, 202b, 202c and 202d respectively. Any of a variety of readily available structural shapes formed of a variety of common materials may be adapted for use for legs 201a, 201b, 201c and 201d. As shown here, a length of rebar is utilized for each legs 201a, 201b, 201c and 201d. Form suspension assembly 250 includes straps 252a, 252b, 252c and 252d each formed as an extension of an upper edge 255 of pliable tubular segment 231. Each strap 252a, 252b, 252c and 252d includes an aperture, apertures 253a and 253b being shown in Figure 39. Upper distal ends 202a, 202b, 202c and 202d of legs 201a, 201b, 201c and 201d are passed through the apertures formed in each strap 252a, 252b, 252c and 252d, apertures 253a and 253b being shown in Figure 39, as seen with specific reference to distal ends 202a and 202b shown passing through 253a and 253b respectively. Straps 252a, 252b, 252c and 252d are passed about and over distal ends 202a, 202b, 202c and 202d respectively as shown with specific reference to strap 252d which is shown passed about and over distal ends 202d. Retaining caps 251a, 251b, 251c and 251d are then placed over upper distal ends 202a, 202b, 202c and 202d of legs 201a, 201b, 201c and 201d as shown with specific reference to retaining cap 251c shown place over upper distal end 202c of leg 201c securing strap 252c.

(064) Figures 40 through 42 show casting form 400 including pliable tubular segment 410, suspension assembly 420 and connecting member attachment assembly 430. Casting form 400 also includes form block-out 430 which in the embodiment shown includes block 432 formed of material having a cross-sectional configuration that is substantially identical a cross-sectional configuration of an

element to be inserted, (not shown), following casting and curing the structural element. In a preferred embodiment, block 432 is formed of a polystyrene material that is readily formed or shaped to have a perimeter and cross-sectional configuration of the element to be inserted in the void formed in the structural member in the manner described herein. Block 432 is inserted into plastic sheath 431, as shown in Figure 40, and wrapped, as shown in Figure 41, so block 432 is covered with plastic sheath 431 including end panels 433 and 434. Form block-out 430 is then inserted into pliable tubular segment 410 and located at a selected position, as shown in Figure 42, and plastic weld 435 seals plastic sheath 431 to sidewall 411 of pliable tubular segment 410. Referring to Figure 43, following casting, form block-out 430 may be readily removed from post P leaving voids V1 through V3. Rails R1 through R3 are insertable, as shown in voids V1 through V3.

(065) While this invention has been described with reference to the detailed embodiments, this is not meant to be construed in a limiting sense. Various modifications to the described embodiments as well as the inclusion or exclusion of additional embodiments will be apparent to persons skilled in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications or embodiments as fall within the true scope of the invention.